

## CLAIMS

1. A pulse tube refrigerator, comprising:

a pressure-waveform generating device for generating a pressure waveform of refrigerant gas;

a pulse tube into which refrigerant gas with the pressure waveform generated by said pressure-waveform generating device flows, one of whose ends is adapted to a low-temperature end, and the other one of whose ends is adapted to a high-temperature end;

a cold accumulator disposed between said pressure-waveform generating device and said pulse tube, and pre-cooling the refrigerant gas to be flowed into said pulse tube;

a pressure-waveform phase controlling element having a buffer tank communicating with the high-temperature end of said pulse tube, and controlling a pressure-waveform phase of the refrigerant gas for generating refrigeration at the low-temperature end of said pulse tube; and

a vacuum heat-insulation bath having a vacuum heat-insulation chamber for accommodating said pulse tube,

wherein the pulse tube refrigerator is characterized in that said buffer tank is placed within said vacuum heat-insulation chamber of said vacuum heat-insulation bath.

2. A pulse tube refrigerator, comprising:

a pressure-waveform generating device for generating a pressure waveform of refrigerant gas;

a pulse tube into which refrigerant gas with the pressure waveform generated by said pressure-waveform generating device

flows, one of whose ends is adapted to a low-temperature end, and the other one of whose ends is adapted to a high-temperature end;

a cold accumulator disposed between said pressure waveform generating device and said pulse tube, and pre-cooling the refrigerant gas to be flowed into said pulse tube;

a pressure-waveform phase controlling element having an inertance tube communicating with the high-temperature end of said pulse tube and having a flow passage with a smaller inside diameter than an inside diameter of said pulse tube, a buffer tank communicating with the high-temperature end of said pulse tube by way of said inertance tube, and controlling a pressure-waveform phase of the refrigerant gas for generating refrigeration at the low-temperature end of said pulse tube; and

a vacuum heat-insulation bath having a vacuum heat-insulation chamber for accommodating said pulse tube,

wherein the pulse tube refrigerator is characterized in that said inertance tube is placed within said vacuum heat-insulation chamber of said vacuum heat-insulation bath.

3. A pulse tube refrigerator, comprising:

a pressure-waveform generating device for generating a pressure waveform of refrigerant gas;

a first pulse tube into which refrigerant gas with the pressure waveform generated by said pressure-waveform generating device flows, one of whose ends is adapted to a low-temperature end, and the other one of whose ends is adapted to a high-temperature end;

a second pulse tube into which refrigerant gas with a pressure waveform flows, one of whose ends is adapted to a low-temperature

end, the low-temperature end becoming a lower temperature than the low-temperature end of said first pulse tube, and the other one of whose ends is adapted to a high-temperature end;

a cold accumulator disposed between said pressure-waveform generating device, said first pulse tube and said second pulse tube, and pre-cooling the refrigerant gas to be flowed into said first pulse tube and/or said second pulse tube;

a pressure-waveform phase controlling element having a first inertance tube communicating with the high-temperature end of said first pulse tube and having a flow passage with a smaller inside diameter than an inside diameter of said first pulse tube, a first buffer tank communicating with the high-temperature end of said first pulse tube by way of said first inertance tube, a second inertance tube communicating with the high-temperature end of said second pulse tube and having a flow passage with a smaller inside diameter than an inside diameter of said second pulse tube, and a second buffer tank communicating with the high-temperature end of said second pulse tube by way of said second inertance tube, and controlling pressure-waveform phases of the refrigerant gas for generating refrigeration; and

a vacuum heat-insulation bath having a vacuum heat-insulation chamber for accommodating said second pulse tube at least,

wherein a cooling element contacting thermally with the low-temperature end of said first pulse tube and being cooled by refrigeration from the low-temperature end of said first pulse tube is disposed, and said cooling element is brought into contact with said second inertance tube thermally.

4. A pulse tube refrigerator, comprising:

a pressure-waveform generating device for generating a pressure waveform of refrigerant gas;

a first pulse tube into which refrigerant gas with the pressure waveform generated by said pressure-waveform generating device flows, one of whose ends is adapted to a low-temperature end, and the other one of whose ends is adapted to a high-temperature end;

a second pulse tube into which refrigerant gas with a pressure waveform flows, one of whose ends is adapted to a low-temperature end, the low-temperature end becoming a lower temperature than the low-temperature end of said first pulse tube, and the other one of whose ends is adapted to a high-temperature end;

a cold accumulator disposed between said pressure-waveform generating device, said first pulse tube and said second pulse tube, and pre-cooling the refrigerant gas to be flowed into said first pulse tube and/or said second pulse tube;

a pressure-waveform phase controlling element having a first inertance tube communicating with the high-temperature end of said first pulse tube and having a flow passage with a smaller inside diameter than an inside diameter of said first pulse tube, a first buffer tank communicating with the high-temperature end of said first pulse tube by way of said first inertance tube, a second inertance tube communicating with the high-temperature end of said second pulse tube and having a flow passage with a smaller inside diameter than an inside diameter of said second pulse tube, and a second buffer tank communicating with the high-temperature end of said second pulse tube by way of said second inertance tube, and controlling pressure-waveform phases of the refrigerant gas for

generating refrigeration; and

a vacuum heat-insulation bath having a vacuum heat-insulation chamber for accommodating said second pulse tube at least,

wherein a cooling element contacting thermally with the low-temperature end of said first pulse tube and being cooled by refrigeration from the low-temperature end of said first pulse tube is disposed, and said cooling element is brought into contact with said second buffer tank thermally.

5. A pulse tube refrigerator, comprising:

a pressure-waveform generating device for generating a pressure waveform of refrigerant gas;

a first pulse tube into which refrigerant gas with the pressure waveform generated by said pressure-waveform generating device flows, one of whose ends is adapted to a low-temperature end, and the other one of whose ends is adapted to a high-temperature end;

a second pulse tube into which refrigerant gas with a pressure waveform flows, one of whose ends is adapted to a low-temperature end, the low-temperature end becoming a lower temperature than the low-temperature end of said first pulse tube, and the other one of whose ends is adapted to a high-temperature end;

a cold accumulator disposed between said pressure-waveform generating device, said first pulse tube and said second pulse tube, and pre-cooling the refrigerant gas to be flowed into said first pulse tube and said second pulse tube;

a pressure-waveform phase controlling element having a first inertance tube communicating with the high-temperature end of said first pulse tube and having a flow passage with a smaller inside

diameter than an inside diameter of said first pulse tube, a first buffer tank communicating with the high-temperature end of said first pulse tube by way of said first inertance tube, a second inertance tube communicating with the high-temperature end of said second pulse tube and having a flow passage with a smaller inside diameter than an inside diameter of said second pulse tube, and a second buffer tank communicating with the high-temperature end of said second pulse tube by way of said second inertance tube, and controlling pressure-waveform phases of the refrigerant gas for generating refrigeration; and

a vacuum heat-insulation bath having a vacuum heat-insulation chamber for accommodating said second pulse tube at least,

wherein at least a part of said second inertance tube is brought into contact with the low-temperature end of said first pulse tube thermally.